How Multiport Works

What Multiport is...

APPENDIX B
FEDERAL COMMUNICATIONS COMMISSION
ET Docket No. 93-7

Future Trends In Cable Programming and the Impications For Conditional Access Technology

by L. Patrick Mellon, Vice President, Programming, TeleCable Corporation, and Nicholas Worth, Executive Vice President, Engineering, TeleCable Corporation

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Introduction

Few cable industry observers and participants would dispute the fact that the television programming and packaging environment is undergoing dramatic changes. Whether the current atmosphere of flux is regarded with fear, loathing, or the excitement associated with new opportunity, several "themes" are becoming increasingly apparent. It is these themes which together constitute the economic and social "drivers" of the current and future trends in cable television programming.

Each of the drivers we will identify is fundamentally economic in both its essence and consequence. It is therefore unavoidable that the economic relationships between the cable operator and cable subscriber, and the cable operator and cable programmer, will undergo major structural changes over the course of the 1990's. However, one must resist the hyperbole of characterizing the resulting paradigm shifts affecting industry players -- whether operator, programmer, or the all important consumer -- as revolutionary. Rather, these changes should be understood to be the timely coalescence of each of three distinct, but symbiotic trend drivers. Accordingly, one is compelled to the conclusion that current trends in cable television programming are as evolutionary in nature, as they are predictable in terms of their future direction. For purposes of discussion here, we have identified three dominant drivers of programming trends: i) Customization; ii) Regulation; and iii) Technology.

Customization

Economist Harry S. Dent, Jr. in his recent best seller, "The Great Boom Ahead" predicts; "we're moving into an increasingly global "Customized Economy" in which flexibility and creativity will be the decisive factors". Mr. Dent's prophetic view of the nineties consumer mirrors the cable television experience. The consumer has spoken, and has made the point loud and clear, that choice and control relative to cable programming selection is fundamental to the assessment of product value.

While one might trace the root of the customization factor to demographic and psychographic changes in our society, such as the maturation of the proverbial "baby boomer", the cause becomes merely academic to the discussion of effect. A "standardized" economic model for cable television programming distribution was clearly necessary to the development of the hardware infrastructure (i.e. plant), and software

innovation (i.e. cable networks). "Pushing" all subscribers through one or two standard packages provided the financial fuel to grow the industry into adolescence. However, current operating experience and research cries out that the consumer will no longer tolerate a "standardized" approach to programming packaging.[1]

Price is often touted as the major factor fueling this trend. As Peter Low, Vice President of Programming, Cablevision Systems observed, "....subscribers are telling us they resent having new services added to their current packages in exchange for higher prices." However, recent consumer behavior suggests price sensitivity alone does not make for the complex marketing environment facing the industry (if this were the case, a simple elasticity model and appropriate discounting would provide both a simple and relatively painless solution). Statistics indicate most average entertainment consuming households supplement their cable television service with the renting of videotapes.[2] Accordingly, the issues of choice at the desired time of viewing, and control over the television experience transcend the price debate.

Bruce Springsteen echoed best, perhaps, the demands and frustrated expectations of the new cable television consumer "57 channels and nothing on". The cynicism implicit in Mr. Springstein's lyrics reflects a broader crisis for the cable marketeer. The price-value relationship is becoming increasingly personal and variable in nature for the consumer. Mere abundance, without customization to my preferences (and implicitly, my schedule, my values, etc., etc.) does not yield value. TCI's COO Brendon Clouston was recently quoted on this subject, "people want more choices and they only want to pay for what they watch". TCI is changing its operating policies and infrastructure because they apparently recognize that the economic model based on the mass cross-subsidization of a multitude of narrowcast programming options by the entire subscriber base, has matured to its natural obsolescence.

Time management is also important to the new consumer of entertainment. They have less time, but want to maximize both their time and their entertainment dollar. Clearly, convenience in accessing and selecting product, obtaining information about it, and controlling their viewing time is all part of maximizing their control over the television experience. The historical technological and/or economic impediments to videotaping, to the viewing of cable programming on second sets, and to exploiting the technical features of home television receivers, is central to the value, control, and choice equation.

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[1]TeleCable's subscriber satisfaction focus groups conducted in August, 1992 indicate heightened dissatisfaction by subscribers with having to pay for channels they do not watch.

[2]TeleCable's research shows that over two-thirds of the respondents who own a VCR, rented a movie within the past four weeks, and regularly do so. Eighty-nine percent of TeleCable's pay subscribers own a VCR compared to seventy-seven percent of basic subscribers.

Regulation

We have seen that the marketplace demand for the new customization is at odds with the traditional cable television economic model (i.e. product "standardization"). However, customization carries with it more immediate and fundamental technological burdens as such relates to signal security (i.e. conditional access). The industry was predictably but violently forced to quickly adopt a new set of business policies and priorities. The policy objectives of Congress as stated in Section 628 of the 1992 Cable Act are explicit: "to promote increased competition and diversity in the multichannel video programming market."[3] In a general sense, both the realities of inevitable competition, and the policy objective of programming diversity suggests that current business priorities must also include a greater diversity in programming packaging by the cable operator. This enhanced form of customization will clearly require the need to develop a more sophisticated means of conditional access.

We need only look to certain specific elements of the new regulatory scheme for further evidence that the 1992 Act has become a major short term driver of longer term trends, with broader implications for cable programming, packaging, and marketing. The 1992 Act's two tier system of regulation, specifically confers local jurisdiction over "basic cable service" rates. The operator is implicitly encouraged -- if not compelled -- to separate high cost basic programming networks (e.g. sports and movies), from local broadcast and public education and government access (PEG) services, which will be subject to stricter and more well defined pricing parameters. Similarly, the "anti-buy through" provisions of the 1992 Act, which prevent "discrimination" in access to pay programming by subscribers of the lowest cost cable package (i.e. basic lifeline), also require a major deviation from the traditional pricing, packaging, and signal security techniques currently utilized by most cable operators.

Technology

The last trend driver we will discuss is technology. In this sense, technology takes on somewhat an amorphous character. While technological innovation is often the product of existing market trends, here we will briefly examine the impact of recent technological developments as a catalyst for future programming and packaging innovation. Time-Warner's announcement of the 1Ghz., 150 channel cable system test in New York was historical. The technology has been available for some time to provide such abundance. Cynics pooh-poohed the announcement as a public relations ploy. However, it was Time-Warner's signaling of its belief that a consumer appetite was developing for this quantity

was obtainable largely through new subscriber revenue, that shocked the industry. Since then, "near video - on - demand" (NVOD) has attracted considerable interest (for example Viacom, Comcast, and Cox Cable all have similar tests in various stages of development). As the age of channel abundance approaches, technological developments which will allow for interactive programming and a plethora of pay-per-view (PPV) options, are convincing skeptics that an acceptable return on investment actually may exist in the near term. Simultaneously, a lower cost method (vs. fiber) of increasing capacity, while improving video quality -- through digital compression -- offers encouraging prospects.

The world is becoming a digital environment with multimedia and compression pushing the transition. It is the digital standard which is the most important change - picture improvement is a secondary benefit. Compression presupposes the advent of new targeted packages of enhanced programming and services, distributed to segments of the market necessary to financially support the required capital costs. This segment will demand more options, choice, and quality. HDTV is just one acronym in the expanding lexicon of potential product and service enhancements poised to gobble up more video paths in the digital cable system of the nineties. The "new-home media center" will be the natural consequence of the digital synergy between TV, cable, computers, CD, satellite, and telephone. This blurring between traditional boundaries based on distribution channels will cause strange, new, and exciting alliances between the various players in the affected industries.

Finally, in concert with the development of fiber technology and expanded bandwidths for increased narrowcasting and the coming digital age, we have simultaneous developments in competitive technology such as DBS, Cellularvision, and increased MMDS capacity (through compression). These competitive technologies serve as a further economic stimulus to the cable industry to forge not only new alliances, but new directions in cable programming and packaging which are increasingly responsive to consumer demands. Driven by technology's promises, tomorrow's "media" winners will be forced to redefine their businesses to adapt to a changed environment. The ability to target segments will be a key attribute of this new environment.

Trends in Basic Programming

As we have discussed, driven by the marketplace demands for customization, the requirements of regulation, and emerging technological developments (to include competitive technologies); the renewal of interest in "tiering" by cable operators was as necessary as it was predictable. The clear trend is towards the creation of tiers to accommodate new programming. Product cost containment for the cable operator, and price-value efficiency for the consumer, will be the fundamental economic factors underlying their design.

However, equally fundamental to the new packaging structures must be the perceived benefit of control for the consumer. Ironically, "choice", the old and overly exploited cable feature, has become somewhat of a bane to both the consumer and the operator. To the operator, while choice fueled the cable boom of the eighties, it has left the over zealous operator with the legacy of high retail rates (which are now subject to regulation), a high debt ratio, and high variable programming costs accelerating at two to three times the percentage increase in basic service revenue. This disequilibrium is occurring at the genesis of the period with the greatest new capital investment in plant infrastructure the industry may ever see. All, of course, in an environment of increased direct competition from multi-channel providers!

Research on cable resisters conducted in Boston among Public Television supporters best highlights the "choice dilemma" from the consumer's perspective. Here, the major findings conclude this population believes cable TV offers too many choices, and sees cable as a poor value since they want to pay for only what they use.[4] As primarily eduction and information seekers, they want quality and the ability to select the channels in their tier (a' la Video-on-Demand). This group has a strong resentment to being forced to receive programming they do not want because it is part of a given package. Hence, more is <u>not</u> necessarily better for this particular segment, one which has the up-scale demographic/psychographic attributes of television's most desirable entertainment consumer.

The trend away from what we might term "naked choice", and toward control and value will provide the impetus for operators to create interest clusters (i.e. "affinity tiers") which target segments with the programs they want. Cable networks will continue to be pressured by operators for a' la carte distribution rights, which most networks will bitterly resist, to preserve their coveted advertising base.

Cable vertical integration with major programming network groups will prove of greatest strategic value in this context. Here, it is the vertically controlled networks which will be the leaders in training Madison Avenue's advertisers. The advertising community will be forced to buy cable networks differently, moving away from archaic barometers like CPM analysis, and towards a "target segment" based analysis. Such will ultimately become easier for Madison Avenue, as broadcaster distribution alternatives become increasingly inefficient due to a loss in share, high comparative cost, and concomitant pressures by broadcasters to define their audience through greater narrowcasting. The economics of basic cable networks will shift away from the traditional business plan based on the majority of revenue derived from advertiser support, towards a more even relationship between affiliate fees and advertising revenue for the more mature networks. As the size of both the advertising market and basic cable grows, network revenue will also continue

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[4]This study was conducted by Patricia Harris of WGBH-TV among non-cable subscribers to public television.

to blossom. The flexible rate structures of vertically controlled networks which will allow for a multitude of distribution configurations within each system, ranging from a la carte, low penetrated tiers (i.e. "segment tiers"), to "standard distribution" (i.e. enhanced basic), will force the resistent networks to redefine their business practices to serve their affiliated cable operators.

New services, such as The Cartoon Channel, The Science Fiction Channel, and Court T.V. will find that distribution will often only be available via tiers. The era of universal distribution has ended, and these services already have responded with flexible rate structures and modified expectations which deviate dramatically from the business plans which conceived their initial creation. The message is clear for the immature network; the operator's "base business" cannot finance their distribution. Accordingly, incremental revenues must match the source of incremental costs (and rate increases will not be the vehicle).

The trend towards regionalization in basic sports and news programming provides another dilemma of irreconcilable dimensions for the operator and programmer alike. Regional sports and news provide cable an important source of proprietary differentiation versus the national multi-channel distributors such as Direct Broadcast Satellite (DBS). Yet, both news and sports are expensive in terms of their respective rights and/or production costs, and such costs must be spread over a comparatively small, and finite regional universe. The regional advertising environment is limited, but the value -- particularly for sports -- is immense to a large portion (but actually not the majority) of the region's cable subscribers.[5] This is a case study indeed in economic inefficiency. As new regional services develop, and as the rates of existing regional services continue to climb, pressures on the operator to tier these services will increase. While this is also true for all of the most expensive networks available on cable, such a trend has a particularly heinous impact on regional services, which by definition have distribution limitations which impact advertising revenue.

Hence, regional networks will also be forced to tier their programs within the network framework and develop a multi-level distribution scheme. For example, a "national platform" for a regional sports network of sports-talk and national events might be carried as a part of a standard level of service, while local games are tiered, and important

The new direction in basic programming will spawn a new basic programming product category. Basic cable programming generally falls into four categories: 1) "vertical"[6] networks such as CNBC, ESPN, and CNN; 2) "environmental"[7] networks such as MTV, BET, and Lifetime; 3) "genre" networks like AMC, Cartoon, and Science Fiction; and 4) "horizontal"[8] networks such as USA and TNT. A new category of "niche" networks is on the horizon. Examples include the recently announced Food Channel, CNN International, and Romance Classics. Such networks will have some of the content and audience attributes of the vertical, environmental, or genre networks; but their target audience is smaller, their focus narrower, and their economic structure designed in expectation of a more limited and flexible distribution scheme. In most instances, the niche networks will evolve as line extensions of existing networks allowing considerable economic efficiencies in distribution, programming, and advertising sales. The trend toward niche networks is, by definition, in direct response to an evolving market for customized, special interest packages which could only find distribution in an environment of expanded channel capacity.

Pay Programming: A Historical Perspective

The launch of HBO in 1972 was historical as a major contributor to the growth of cable television. For the operator, HBO provided the "pull" through basic that fueled dramatic growth in penetration and revenue. HBO was the basis for the initial application of cable's security needs through the use of trap filters to control access by non-subscribers. For the consumer, HBO provided the consumer's first access on the small screen to Hollywood's best, on a commercial free and unedited basis, and generally within a year of the movie's theatrical distribution. It was an "out of the home" entertainment experience, brought into the home. It was a boon for HBO, the cable operator, and the consumer alike.

Almost as quickly as the industry and society adjusted to distributing theatrical entertainment to the home, "multi-pay" evolved. The fundamental marketing proposition was "choice" and "options". Showtime and The Movie Channel evolved as competitive brands. Later, HBO created a line extension "flanker brand" in Cinemax as

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[6]"Vertical" networks program one type of entertainment material or information on a consistent basis during all parts of the daily schedule.

[7]"Environmental" networks are defined by the author as those networks which offer diverse programming to a specific demographic or segment, on a consistent basis. Although often dayparted, such networks provide an "environment" to an audience with shared characteristics (and/or attitudes, values, experiences, etc.)

[8]"Horizontal" networks program various and diverse programming, on a dayparted basis, with the intent of maximizing audience reach and viewership through broad appeal programming. Broadcasters are by definition "horizontal" programmers (i.e., serving a "broad" versus a narrower audience).

complimentary to HBO. Disney and Playboy evolved as niche pay networks, designed to capitalize on the multi-pay marketing thrust, expanding channel capacities, and mushrooming pay television cash flow.

With pay television's growth, so came the "cable box". Converters were born of the need to compensate for deficiencies in television turners (e.g. direct pick-up interference) and to expand the 12 channel tuners of television receivers which pre-dated cable ready sets as channel capacity expanded. As scrambling was introduced, decoders became the means of securing scrambled pay signals carried on higher band channels. Trapping became increasingly expensive due to subscriber "churn" in and out of pay services, each requiring (before scrambling) an on site visit to add or drop the respective network.

The decade of the eighties witnessed major changes in the pay television industry. The consolidation of pay services occurred as the motion picture studios sought higher royalty fees from the burgeoning pay networks. This occurred concurrent with consolidations by cable operators into larger and fewer MSO's, each with increased leverage. Of greater consequence, with the eighties came an acceleration in the penetration of VCR's, and the birth and growth of a powerful new viable competitor in the form of the videocassette industry. Movies were now available three to six months after the end of their theatrical run on videocassette, and the consumer had the ultimate in choice. Finally, there was an answer to the complaints of repetition of movies within each pay service, and

primary suppliers (HBO and Showtime) have continued to increase the number of original productions, series, and special events, to enhance the value of the category, reduce repetition, and increase retention.

More recently, the pay television marketing focus has been on packaging to increase retention. Examples include the packaging of the foundation pay networks with a mini-pay in a so-called "Added Value" configuration such as Showtime's Flix. Both the Disney Channel and The Movie Channel have advocated the distribution of their services as a part of a tier with other basic services. HBO's introduction in TeleCable systems of "multiplexing"[9] was designed to address not only the perceived value issue, but the repetition problem as well by creating multiple viewing options in each daypart. Multiplexing was a pure retention play. However, for many subscribers, absolute price proved an inhibitor to pay television retention. However, for TeleCable's heavy user group of mostly multi-pay subscribers, the results are encouraging for this particular segment's appreciation of the added choice and viewing alternatives multiplexing provides.

These recent trends are most instructive as to future directions. First, it is clear that premium television as defined as a particular solitary channel sold separately, will redefine itself as a category. The trend will be towards premium tiers which are made up of a variety of services, packaged in different ways. Each of the "foundation" pay services (i.e. HBO, Showtime), may be available as "mini-pays" when purchased as a solitary channel, and if so priced and packaged this way by the operator. Thus, the distinction between "mini-pay" (e.g. Flix, Encore) and "full pay" (HBO, Showtime) will become increasingly blurred.

In most instances, trends suggest the consumer must have the choice to purchase the product in a variety of configurations within the same cable system; whether a la carte, packaged with other services (e.g., a Showtime, Flix and TMC movie tier), or multiplexed. However, trends suggest operators will continue to confront price resistance. This may require premium channel prices to come down in search of greater volume. Similarly, the premium networks will each develop multi-tiered rate cards which recognize variations in retail pricing and reward volume, thus requiring greater wholesale rate flexibility. The movie studios will have to participate in this effort if the pay television revenue stream is to be maintained by Hollywood.

Pay services will also be sold by cable operators to non-subs and certainly without buy-through restrictions to "basic lifeline" subscribers. Pricing schemes will be developed to allow this distribution on an a la carte or packaged (tiered) basis. The trend towards the increased packaging of pay services with advertiser supported services will continue to

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[9]Multiplexing was introduced in 1992 by HBO. Three HBO channels and two Cinemax channels are available, each with different programs at any particular time.

develop. These packages must be conceived based on how the various market segments use the product. Multiplexing is here to stay as only the first step towards "pay tiering". Multi-pay will exist as only one of many pay tiers for heavy users, but at a reduced retail price. It is this segment however, which will provide the base for Video-On-Demand (VOD). Accordingly, new PPV and enhanced service revenues will likely replace the margin lost from Multi-pay households.

Trends in Pay-Per-View Programming

The future of pay-per-view is tied to three factors: 1) digital delivery; 2) movies; and 3) niche events. Pay-per-view is still in its embryonic stages, and it will continue to be as long as it must exist in an analog environment. Most cable operators carry two channels of PPV programming, distributed via one of two major PPV networks with a "potpourri" schedule. Currently, operators are in the process of adding additional quasi niche PPV channels (i.e. Playboy and Action PPV). Viewer's Choice has launched Continuous Hits (a single movie per week format), which signals the emergence of the "program" focus versus the "Network" focus heretofore necessary to maximize buy rates, ensure program volume, choice and variety, all within limited bandwidth. With digital compression, Near

of cable subscribers report they frequently cannot find something they want to watch on television. Historically, T.V. Guide and newspaper T.V. listings have been the primary sources for television viewing information for cable users. Both sources have improved considerably in the comprehensiveness of their listings of cable programming. This has largely been a direct result of both T.V. Guide's and the local press' desire to maintain market share and position in the area of television listing information. Cable operators have generally been eager to abdicate control and participation in the publishing of television listings to the established vehicles, as a means of reducing their own lofty operating expenses associated with the providing of guides.

Networks have long recognized the correlation between program listing information and viewership. For this reason, they have participated with the cable operator in encouraging the local and national print press to include the listings of their respective networks. Pay networks still publish proprietary guides, but generally do so as a part of an unwelcome cost center they would prefer to avoid, if such was not so fundamental to pay service promotion, usage, and ultimately retention. Recent trends indicate an increased recognition on the part of operators in the importance of providing channel listing information. Accordingly, on-screen guides have seen a renaissance. While born out of the crude, alphanumeric, on-screen listings which cable offered in the early eighties; today's on screen guides are increasingly user friendly. Operators are recognizing that "channel grazing" becomes increasingly cumbersome as channel capacities grow. Further, channel flipping fails to expose the value of cable, versus "planned viewing".

Prevue Guide, an on-screen guide which previews programs in video through use of a compressed screen, while also providing a flexible listing of programs through a rolling log, continues to gain distribution and increased usage. Similarly, operator's have now accepted the fact that PPV cannot effectively be offered without a full time promotional channel which provides a road map to movie and special event start times, channel location, and ordering instructions. The PPV "barker channel" has helped establish the concept of efficiently providing information on demand on a low cost basis. The barker channel has evolved as PPV's primary marketing vehicle.

The era of channel abundance will require even more sophisticated sources of program information. Two proposals for future interactive channel directories have attracted significant industry interest. Insight is one such service to be distributed via satellite on the vertical blanking interval (VBI). Insight will offer user friendly interactive information by product category. John Hendricks, Chairman of The Discover Channel, has proposed Your Choice T.V., a nationally delivered menu of programs available on demand. The software and packaging is provided by Your Choice T.V., which will require a separate decoder and remote control. In assembling the on demand environment, the service actually tunes to a particular program for the viewer through an on-screen directory similar in appearance to an Apple computer.

Clearly, there will be other innovations, with the help of microchip technology, which will

provide viewers a directory and sub-directory of various types of channels and program categories. Video driven channel guides to pay tiers, offering on-going promotion of current movie offerings which parallel the format of PPV barker channels may evolve as a sub-directory, if you will, of the interactive program listing directory. In terms of attributes; flexibility, ease and speed of use, and simplicity will be paramount. Program guides may likely become customizable, based on the specific channels, tiers, or packages to which the household subscribes. The "favorite channel feature" has for sometime has been available as a built in guide feature of today's addressable decoders. Compatible universal remote controls which are provided by some operators, already allow for guide interactivity in terms of exploiting this feature.

Implications for Future Conditional Access Technology

The trend away from packaging for mass audiences towards customized packaging for smaller audiences and ultimately to viewer controlled television, implies that future conditional access systems must be able to secure and control many more levels of service and with much greater automation and efficiency (e.g., customer control by interactive means) than previous systems. Technology which has a very modest number of controllable channels (e.g. trap filters) will no longer be practical and systems which have a limited number of controllable channels (e.g., interdiction, broadband descrambling) many be obsolescent. The only technologies which promise to allow channel by channel and program by program control of 100 or more services are analog scrambling and digital encryption. However, such scrambling will complicate the use of newly purchased TV sets and VCR's.

Two potential solutions are (1) the development of a universal encryption standard which would ultimately enable decoders to be integrated with TV's and VCR's and (2) the installation of decoder interface plugs conforming to EIA Standard 563 in new TV's and VCR's. Given the disastrous past experience of universal scrambling schemes (e.g., Videocipher II) and the fact that EIA 563 is already developed, solution no. 2 would seem to be more practical for the near future.

The fact that cable systems' program offerings and channel capacities have out paced T.V. tuner capacities (see table below) and are likely to continue to do so, implies that cable operators may have to continue to supply tuners to many of their customers for years to come. However, customers who have recently purchased new TV's or VCR's, desire to use their TV or VCR tuners for channel selection.

Cable Channel Capacity Milestone	Time
12	Early 1960's
21	Late 1960's
30	Mid 1970's
36	Late 1970's
52	Early 1980's
60	Mid 1980's
80	1990
110	1992
500	Mid 1990's ?

A potential solution for the segment of customers who are purchasing new TV's and VCR's is the incorporation of decoder interface plugs conforming to EIA 563 in new, advanced featured TV's and VCR's and the supplying of matching decoders by cable operators. Component style TV tuners equipped with decoder interface plugs could be developed and sold to customers who purchased TV's prior to the establishment of the standard. These component tuners could be compatible with the remote controls purchased with the original TV's and interconnection could be accomplished at the baseband video, and audio (L, R) level.

To choose from the myriad of services which future cable systems will provide, customers will need a means of obtaining program information far more efficient than present printed guides. "Zipping" through 100 channels, given the 1-2 second time required to acquire channel synchronization, will not be practical. As previously mentioned, several suppliers have developed innovative electronic program guides which allow program selection through the assistance of on-screen displays which resemble spread sheet windows. Time (e.g. 8:30 p.m.) are arrayed as column headers and networks (e.g., CNN) are arrayed as row headers. Using up/down and left/right arrow keys, a viewer can quickly determine what is on each network at the desired viewing time. Alternately, viewers can make their selections by program category and sub category (e.g. movies, adventure). such systems will allow video taping at the touch of a button.

The aforementioned guides will be needed in a shorter time frame than will result from the natural replacement of TV's.[10] The capability to deliver, store and display such information is being built into the latest generation of cable set top decoders. Capability to receive, store and display electronic guide information can also be built into future EIA 563 compatible decoders, to accelerate the deployment of this service. In the ideal world, the customer should have access to the electronic programming guide service through the means of his or her choice - by purchase of a new TV set with built-in circuitry, or from his or her cable operator.

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[10]The life span of the average TV set exceeds 15 years.

Conclusion

The creation and packaging of television programming are undergoing fundamental changes which are being driven by three factors: consumer demand for customization of television programming packages and control over viewing; regulation, including provisions of "the Cable Television Consumer Protection and Competition Act of 1992"; and technology. These drivers will initially force retiering of basic programming and will ultimately force the offering of enhanced basic services on an "a la carte" basis. Consumer desire for more choice has resulted in the multiplexing of pay signals and is driving the development of video on demand pay per view services.

The trend away from packaging for mass audiences, and towards customization implies that future conditional access systems must be able to control many more levels of service with much greater automation and efficiency. Technology which offers limited, inflexible control (e.g. traps, present interdiction systems) will become obsolete. Only technologies which can control a large number of services, will allow unrestricted growth in programming.

Finally, T.V. viewers will need new means of selecting channels, such as interactive, electronic program guides, and will need these means sooner than can be achieved by the normal replacement of worn-out televisions. Therefore, cable operators must provide electronic program guide technology to consumers in the near future.

The failure to embrace the new environment by the cable industry will be tantamount to the failure of other industries (e.g. Swiss watch manufacturers) to address fundamental changes in their environments.

APPENDIX C
FEDERAL COMMUNICATIONS COMMISSION
ET Docket No. 93-7

Technical and Economic Feasibility of Deploying "Clear Signal" Conditional Access Technology in Cable TV Systems

by Thomas Elliot,
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Technical and Economic Feasibility of Deploying "Clear Signal" Conditional Access Technology in Cable TV Systems

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Introduction and Background

Since the late 1960's, cable operators have supplied to their customers, converters which offered a variety of benefits including remote control, extended channel tuning and immunity to interference from off-air signals. During the mid to latter 1980's, many consumers purchased VCR's and TV's which were advertised as cable ready. However, for certain consumers, use of these products was complicated by the already established cable industry practice of scrambling discretionary cable signals. Since the mid 1980's, cable operators and suppliers have searched for a more consumer friendly means of securing cable signals. As

Early converters served the additional purpose of translating cable signal frequencies to frequencies not used by area broadcasters (e.g. to channel 3 if a local broadcaster operated on Channel 4) to overcome shielding limitations of TV set tuners.

Even after the introduction of television sets which were capable of tuning to cable channels, cable operators found it necessary to continue to supply tuner-converters to many customers. The primary reason for this, aside from TV tuner shielding limitations, was that cable systems expanded channel capacity more rapidly than TV sets turned over.[2]

Channel Capacity	Time
12	Early 1960's
21	Late 1960's
30	Mid 1970's
36	Late 1970's
52	Early 1980's
60	Mid 1980's
80	1991
100	1992
500	Mid 1990's ?

Figure 1 following this page depicts the spectrum of a 550 MHz (80 Channel) broadband cable television system with 6 MHz video channelization.

Because there is no synchronization between cable system channel capacity increases and TV set purchases (consumers in a market cannot be expected to purchase new television sets each time the local cable system increases its channel capacity), the majority of TV receivers in a typical community will not tune in all cable channels. Research performed by TeleCable Corporation in early 1992 in two diverse markets, determined that less than 40% of primary TV sets would select 54 cable channels and less than 25% of secondary TV sets would select 54 cable channels. Thus it has been necessary during the past 20 years for cable operators to provide tuners to the majority of their customers. The acceleration in the provisioning of channel capacity, as evidenced by the table above, makes it likely that this trend will continue. Nevertheless, those customers who have recently purchased advanced television sets or VCR's desire to use their TV and VCR tuners to select channels.

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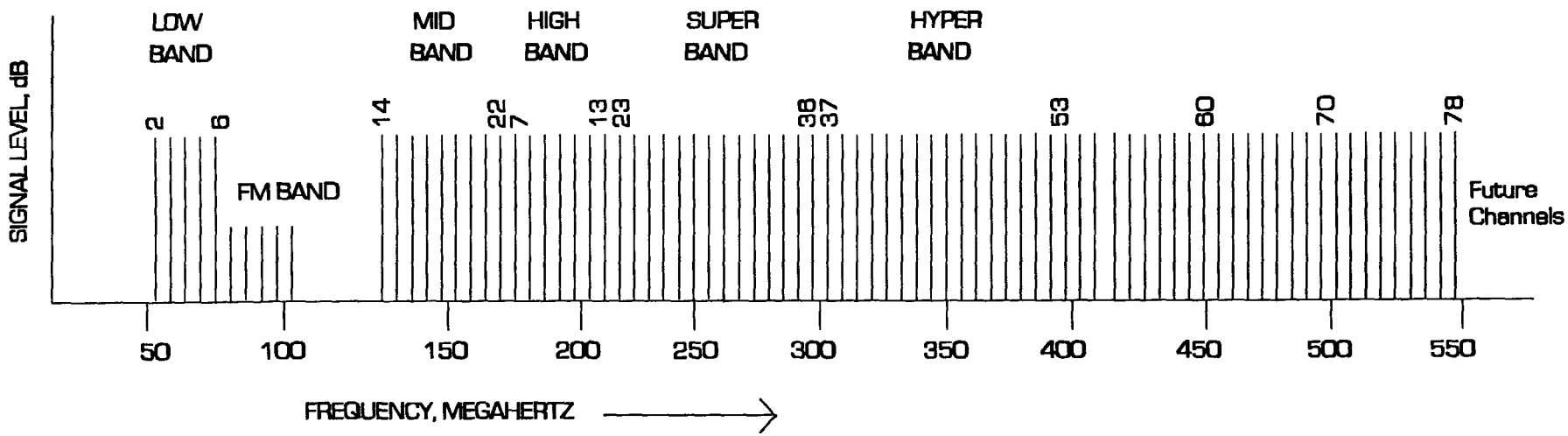
[2] TV sets on average last more than 15 years.

Figure 1: Depiction of a Broadband Cable TV Spectrum



NOTE: Vertical lines represent discrete carrier frequencies within spectral channels.

Security

The widespread demand for pay television in the late 1970's forced cable operators and their suppliers to develop means of securing TV signals on a channel selective basis. The introduction of multiple channels of pay television and satellite ad supported programming in the early 1980's caused cable operators and suppliers to develop more sophisticated means of securing signals. Following is a summary of security means used by the cable industry or proposed by suppliers.

Negative (Denial) Security	Positive (Supply) Security
Trap (band reject) filters	Positive traps
Interdiction	Analog scrambling
	Digital encryption[3]
	Broadband descrambling[4]

In general, negative security devices are installed in series with cable drops to residences and act to deny unauthorized reception of services by effectively removing or obliterating the signals associated with those services. With positive security, TV signals which require protection are scrambled at the head end and descrambling devices are installed in the drops to supply services to those customers who wish to purchase the services associated with those signals.

Positive (supply) security has the desirable characteristic that the cable operator need only make a technology investment for homes which desire to subscribe to the discretionary services. Negative or denial security has the opposite characteristic. As the number of discretionary cable services increases and the penetrations of discretionary services decreases, negative or denial security will become technically and economically infeasible.

Security techniques can also be categorized as to whether channel selection is

Control

Cable operators need an efficient means of controlling security to satisfy customers' desire to add or delete services or purchase services on a per program basis. The efficiency of control of the various security techniques ranges from the labor intensive process of physically installing or removing trap filters, to the electronic addressing of individual descramblers from an office computer.

In the former case, service persons and vehicles must be dispatched to the customer locations. In the latter case, customers may enter orders using simple automated techniques such as ANI[5] and have their orders fulfilled in seconds with itemized records of all transactions included in their monthly bills. As cable operators offer more programming choices to customers (e.g. multiple channels of pay TV or pay-per-view) physical control measures such as traps are rapidly giving way to electronically addressable means.

The combination of security and control is often referred to as **conditional access.**

To date, the cable industry has tended to install conditional access equipment in three different locations. Negative traps and interdiction units have customarily been installed outside homes, on utility poles or in pedestals. Analog descramblers have historically been located on top of TV's and VCR's. EIA 563 Multiport descramblers were located behind TV sets.

Positive and Negative Traps

Negative traps are narrow band reject filters which remove one service while passing all remaining services to customers TV sets and VCR's. Negative traps were the appropriate means of security when cable service consisted of 12 channels of broadcast television programming and one or two highly penetrated pay services (e.g. HBO, Showtime). Negative traps provided an adequate level of security and are still used by many systems to secure their most highly penetrated pay service. Figure 2 following this page depicts the installation of a single trap filter.

Today, approximately 70 cable systems are offering an expanded pay service called Multiplex, which may consist of three channels of HBO, two channels of Cinemax, and two channels of Showtime. Many of these systems also offer the Disney Channel and the Movie Channel, for a total of nine pay services. If negative traps were used to secure these services, 2^9-1 = 511 different combinations of concatenated traps would be required to deliver all possible service combinations.

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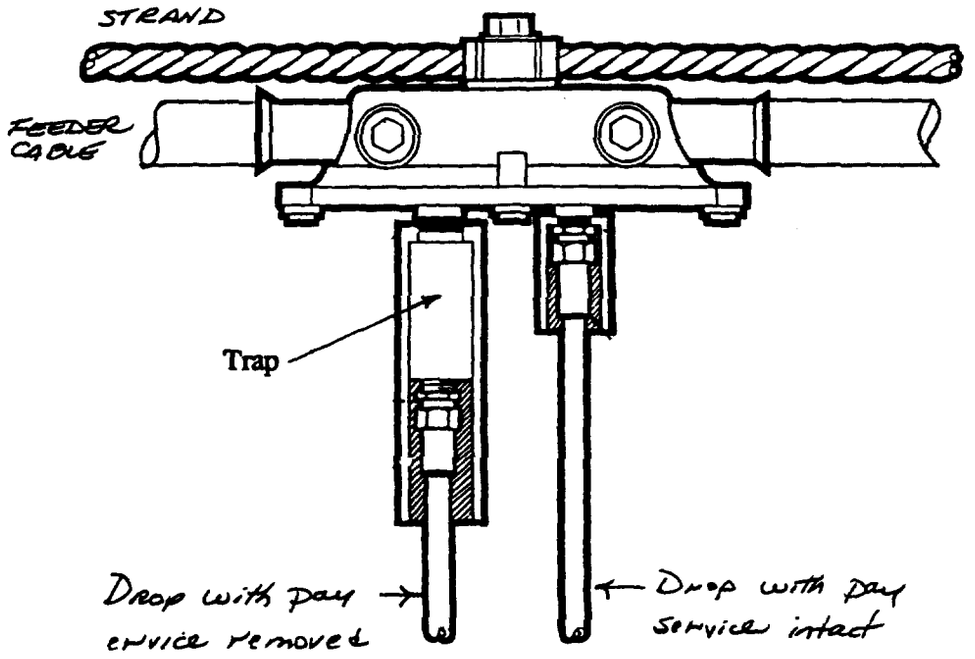
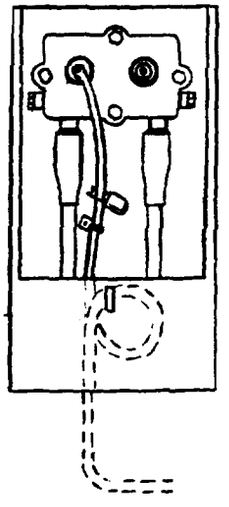
[5] ANI - Automatic Number Identification, a telephone technology in which the called and calling number are forwarded to the called party to enable automatic order fulfillment and billing.

Fig. 2

Close-Up of Aerial Tap Installation
Showing Trap and Trap Shield



Pedestal installation - buried cable



Such an approach is mechanically and operationally infeasible as can be seen from Figure 2.

Negative trap filters have another undesirable characteristic in that their ability to reject one signal while passing others in unaltered form, is not perfect. As the figure in the appendix to this paper shows, a trap filter used to reject one signal will damage the transmission characteristics of the adjacent channels with the greatest impact on the lower adjacent channel. For this reason, negative traps have been used primarily on channels 2, 5, or 14 (refer to Fig. 1), which once had no standard lower adjacent channel. Today, many operators use the channels below 5 and 14, further restricting the use of trap filters.

Further complicating the use of trap filters is pay television churn. During one typical two week period in 1992, more than 4% of TeleCable Corporation's subscribers to HBO, Showtime, Cinemax, Disney or Movie Channel, dropped one of their pay services. On an annualized basis, the figure exceeds 100% of customers. Because TeleCable's overall penetration level remained relatively constant during the past year, the number of customers who added pay services [redacted]

cable industry and the commensurate denial of benefit to customers which would result from freezing program service at present levels, would be enormous.

Interdiction

Interdiction is a means of securing multiple channels of cable television using equipment placed outside of the customer's home, on utility poles or in pedestals. An interdiction unit, in series with a customer's service drop, uses frequency agile oscillators to interdict (jam) those television signals which the customer does not elect to purchase. Interdiction units currently offered for sale incorporate addressable control circuitry.

Interdiction is a negative or denial security means and interdiction modules must be installed in the service drops of all cable system customers. Interdiction acts only on those signals which are to be denied to a home and passes other signals in the clear to TV's and VCR's.

As recently as 1991, seven major suppliers including AM Communications, Anixter, Jerrold, Magnavox, Midwest, Scientific Atlanta and Zenith were readying interdiction systems for the cable market. At present, two major suppliers continue to offer interdiction products: Scientific Atlanta and Philips Broadband (formerly Magnavox). Of the relatively few cable systems using interdiction, most use Scientific Atlanta hardware.

The Scientific Atlanta interdiction module (one per customer) employs four separate oscillators each of which have 16 oscillator time slots available for jamming. Cable system operators who have experimented with interdiction technology generally feel that 4 time slots are necessary to adequately deny viewing of a highly valued pay-per-view event while 3 are necessary to jam a pay service and 2 are necessary to jam an ad supported satellite signal such as ESPN and CNN. Following is one example of the allocation of the 64 oscillator time slots.

1 PPV event channel	@ 4 slots ea.	=	4 slots
3 PP movie channels	@ 3 slots ea.	=	9 slots
9 Pay channels (Multiplex)	@ 3 slots ea.	=	27 slots
12 Ad supported channels	@ 2 slots ea.	=	24 slots
25 Channels			64 slots